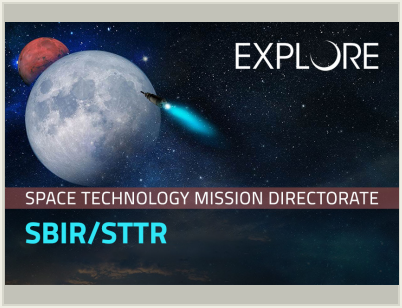
Advanced Gashopper Mobility Technology, Phase I

Completed Technology Project (2007 - 2007)

Project Introduction

The Mars Gas Hopper, or "gashopper" is a novel concept for propulsion of a robust Mars flight and surface exploration vehicle that utilizes indigenous CO2 propellant to enable greatly enhanced mobility. The gashopper will first retrieve CO2 gas from the Martian environment to store it in liquid form at a pressure of about 10 bar. When enough CO2 is stored to make a substantial flight to another Mars site, a thermal storage bed is heated to ~1000 K and the CO2 propellant is warmed to ~300 K to pressurize the tank to ~65 bar. A valve is then opened, allowing the liquid CO2 to pass through the hot thermal storage bed that heats and gasifies the CO2 for propulsion. Gashopper can be designed to function as either ballistic flight vehicles or winged airplanes, with the former offering simplicity and the latter greater range. The advantage of the gashopper is that it provides Mars exploration with a fully controllable aerial reconnaissance vehicle that can repeatedly land and explore surface sites as well. The key technical issue that determines the potential performance of a gashopper is the overall specific heat of the thermal storage bed. In previous work, Pioneer Astronautics has demonstrated working gashopper airplanes and ballistic flight vehicles that utilized magnesium oxide pellets for thermal storage. While convenient for test purposes, MgO has a specific heat that is only roughly equal to CO2. This severely limits the attainable mass ratio and thus vehicle range. In contrast, lithium has four times the specific heat of CO2, so its use as a gashopper thermal bed material would greatly improve vehicle performance. The low density and liquid nature of high temperature lithium makes its utilization for gashopper engines a challenge. In the proposed program, Pioneer will resolve this challenge by designing, building, and testing high specific heat gashopper engines using liquid lithium for thermal storage.



Advanced Gashopper Mobility Technology, Phase I

Table of Contents

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

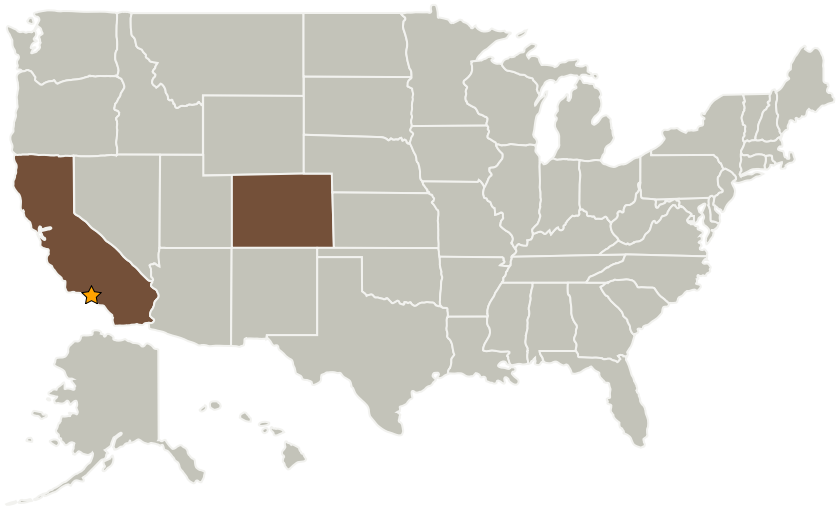
Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Advanced Gashopper Mobility Technology, Phase I

Completed Technology Project (2007 - 2007)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California
Pioneer Astronautics	Supporting Organization	Industry Historically Underutilized Business Zones (HUBZones)	Lakewood, Colorado

Primary U.S. Work Locations	
California	Colorado

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX14 Thermal Management Systems
  - TX14.1 Cryogenic Systems
    - TX14.1.1 In-space Propellant Storage & Utilization